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## **SYSTEM AND METHOD FOR DISPENSING A LIQUID BEVERAGE CONCENTRATE**

### **CROSS-REFERENCE TO RELATED APPLICATION**

This application is a continuation of International application  
10 PCT/EP02/00770 filed January 22, 2002, the entire content of which is expressly  
incorporated herein by reference thereto, and a continuation of U.S. Patent Application No.  
09/768,764 filed January 25, 2001.

### **FIELD OF THE INVENTION**

15 The present invention is related to a device and method for dispensing dual  
component liquids or concentrates packaged in separate compartments or containers. The  
liquids or concentrates can be mixed together, optionally diluted with another liquid, such  
as water, and then dispensed through a pumping system, to provide a consumable beverage.

20

### **BACKGROUND OF THE INVENTION**

Containers used in the packaging art for storing and dispensing liquids  
generally include a sealed polymeric bag or pouch. There are a variety of pouches known  
in the art, particularly for storing liquids or concentrates.

U.S. Patent No. 4,523,697 to Jeans discloses a container for dispensing a  
25 concentrate at a predetermined flow rate. The container also includes two mating  
assemblies, mating at an outlet valve, and a tube in its interior to permit controlled  
pressurization to the volume in the container.

U.S. Patent No. 4,709,835 to Krüger *et al.* discloses a disposable pouch for  
beverage syrups and concentrates including a collapsible bag, a discharge spout, and an  
30 insert that can be broken off when a dosing valve assembly is attached. The pouch has  
utility in a postmix beverage dispenser.

U.S. Patent No. 5,307,955 to Viegas discloses a flaccid-bottom, lightweight  
delivery package for dispensing fluid products. The package contains a self-sealing  
dispensing valve and is particularly useful for storing and dispensing viscous fluid  
35 materials.

Additionally, it may be useful to mix two liquid or concentrate components  
together, especially to create a beverage for consumption. This mixing may occur during

storage or upon dispensing. The two liquids or concentrates can be simply placed together  
5 after dispensation, dispensed together without added mixing, or dispensed together with  
intimate mixing. For example, U.S. Patent Nos. 4,204,775 and 4,316,673 to Speer each  
disclose a mixing device that uses a tortuous path to shear, fold, mix, and blend together a  
two-part fluid compound.

Beverages made from individual components are generally mixed together  
10 and dispensed by a dispensing system. Dispensing systems may be manual or automatic  
and may operate continuously or in discrete dispensation steps. Liquid dispensation  
systems typically involve at least a liquid receptacle for holding the liquid and a pump for  
dispensing the liquid into a consumable portion. A variety of liquid dispensing systems are  
commercially available and disclosed in the prior art.

15 U.S. Patent Nos. 4,306,667; 4,359,432; and 4,376,496, as well as U.S.  
Reissue Patent No. RE 32,179 all to Sedam *et al.*, disclose a post-mix carbonated beverage  
dispensing system for used in refrigerated cabinets. The dispensing system contains a  
carbonator with a refillable water reservoir, a CO<sub>2</sub> system, a valving system, and a  
disposable package for containing and dispensing the post-mix beverage syrup.

20 U.S. Patent No. 4,564,127 to Garabedian *et al.* discloses a liquid dispenser  
system containing a collapsible bag with a self-sealing valve and clips to engage the  
dispenser, clip-receiving structures to engage the bag clips and open or close the valve, a  
pump, support for the bag, and a frame.

U.S. Patent No. 4,901,886 to Kirschner discloses a post-mix juice dispensing  
25 system including a bag-in-tank system for reconstituting and dispensing a juice concentrate  
at freezer temperatures. The bag-in-tank system includes a pressurizable canister with a  
slidable carrier capable of forcing concentrate out of a flexible bag under pressure and  
placed therein.

U.S. Patent No. 5,368,195 to Pleet *et al.* discloses a pressurized bag-in-bottle  
30 fluid dispenser system for accurately delivering a viscous or semi-viscous liquid. The  
dispenser system is particularly suited for dispensing condiments, paints, pigments, or  
adhesives and includes a metering unit activated by a manually operated trigger on a gun.

U.S. Patent Nos. 5,615,801 and 5,735,436 to Schroeder *et al.* disclose a  
disposable and recyclable juice concentrate package for a post-mix juice dispenser. The  
35 dispenser includes a pump that provides a continuous stream of concentrate, a package  
housing containing a container housing and a pump housing, and an integral mixing nozzle.

It is suggested that the continuous streaming of the concentrate into the mixing chamber of  
5 the dispenser improves mixing.

U.S. Patent No. 5,803,312 to Credle, Jr. *et al.* discloses a manually operated,  
postmix juice dispenser. This low cost dispenser is used with a disposable concentrate  
package and includes a water tank, a water pump, and a pump handle. The disposable  
concentrate package for use with this system is generally a flexible pouch with a built-in  
10 concentrate pump that connects to the handle.

In some circumstances, two liquids may be dispensed together by the same  
apparatus. A single apparatus that allows mixing of two liquids results in effectively a  
better mixed consumer beverage product. The two liquids can be dispensed, for example,  
using a dual liquid dispenser package, as disclosed in U.S. Patent No. 4,774,057 to  
15 Uffenheimer *et al.* This patent discloses a dispenser package containing two separate liquid  
dispensing chambers, two liquid reservoirs, and liquid supply channels connecting the  
reservoirs to the chambers.

Coffee products, which are in a form convenient for the consumer, are  
commonly available as soluble beverage powders and ready-to-drink liquid beverages.

20 Coffee products in the form of soluble beverage powders may be of  
extremely high quality; to the point where they provide a beverage very similar to freshly  
brewed beverages. Despite this, they are still perceived as being inferior to freshly brewed  
coffee. Also, the fact that soluble beverage powders are in powder form creates problems in  
many food service applications where the product is dispensed from a machine. In  
25 particular, problems such as mechanical degradation of the powder, bridging, and blocking  
occur. Refilling of the dispensing device with powdered products may also require manual  
operation and cleaning and may cause loss of refill material in loading the machine's  
hopper.

Ready-to-drink liquid coffee beverages are very popular in Asian markets.  
30 The beverages are made up of soluble coffee solids, stabilizers, water and, usually, sugar.  
For whitened beverages, a creamer or whitener may be included. Ordinarily, these  
beverages have a soluble coffee solids concentration of about 1% by weight. These  
beverages are very often consumed cold and, in general, have organoleptic properties which  
are different than freshly brewed coffee. Therefore they do not, and in fact are not intended  
35 to, provide a substitute to freshly brewed coffee.

There have also been attempts to provide convenient coffee products in fluid  
concentrate form. In theory, a coffee concentrate offers the advantages of being perceived

to have better quality than soluble beverage powders, and being simple to apply in food  
5 service applications. Unfortunately, liquid coffee concentrates are unstable and this has  
severely limited their application. One problem appears to be the increase of acidity over  
time which negatively influences the quality of the beverage reconstituted from the coffee  
concentrate. Also, curdling of whitener or creamer components may occur.

Attempts have been made to avoid or reduce the acidity increase by adding  
10 base to the concentrate. For example, European Patent Application No. EP-0861596  
describes treating a coffee concentrate with alkali to convert acid precursors to their acid  
salts, and then neutralizing the treated concentrate with acid to bring the pH to about 4.7 to  
5.3. This process is described to convert the acid precursors to stable salts and hence  
prevent the formation of acid during storage.

15 Another possible method of avoiding or reducing the acidity increase in  
aromatized coffee concentrates is to increase concentration to above about 55%. This is  
described in European Patent Application No. EP-0893065.

When dispensing beverages including two or more fluids, it is desirable that  
the at least two fluids be stored apart and be easily mixed together and with other optional  
20 components using a single dispensation system. This can be advantageously accomplished  
with the aid of a multi-component packing assembly for separate storage of at least two  
fluid components together, allowing uniformity in packaging and dispensation system  
design and resulting in simplified shipping and implementation of dispensing a beverage  
from these at least two fluid components.

25

### **SUMMARY OF THE INVENTION**

The invention relates to a dispensation system for providing a beverage  
product comprising a removable multi-component packing assembly configured and  
designed for storing at least two different components in separate compartments, wherein  
30 the components are capable of forming a beverage after being combined; at least a pump  
assembly for pumping the components from the packing assembly to an addition chamber  
operatively associated with the compartments of the packing assembly for receiving and  
combining the at least two components therein to form a mixture which is delivered as a  
beverage product or beverage forming product.

35 Advantageously, the packing assembly has dual compartments for separately  
retaining the components therein during storage. The packing assembly may be a single  
chamber of a polymer film that is divided to form the two compartments. Alternatively, the

packing assembly may contain at least two separate pouches that form the separate  
5 compartments and that are maintained together by a single outer container or chamber.  
Each compartment may include a fitment to separately dispense the components from the  
compartments. Also, the pump assembly comprises dual-head or multi-head volumetric  
positive displacement pumps, such as peristaltic pumps.

Another aspect of the invention relates to a method for dispensing a beverage  
10 product containing at least two different components. This method includes the steps of  
providing and retaining at least two different components in separate compartments of a  
single packaging outer chamber or container, wherein the components are capable of  
forming a beverage after being combined and the compartments contain relative amounts of  
each component such that the compartments empty uniformly relative to each other at a  
15 determined relative rate so as to become empty at about the same time; combining the at  
least two components by withdrawing them from the outer chamber and mixing them  
together, optionally with a diluent, to form a consumable beverage product; and dispensing  
the consumable beverage product for consumption by a consumer.

Another embodiment of the invention relates to a method for improving  
20 quality of a dispensed coffee beverage containing at least two different components, which  
method comprises providing and retaining at least two different components in separate  
compartments of a single outer chamber, wherein the components are capable of forming a  
coffee beverage after being combined; combining the at least two components by  
withdrawing them from the outer chamber and mixing them together, optionally with a  
25 diluent, to form a consumable beverage product; and dispensing the consumable beverage  
product for consumption by a consumer. Preferably, one component is a coffee base  
concentrate that is substantially free of coffee aroma, and another component is a coffee  
aroma.

Another embodiment of the invention relates to a beverage packaging  
30 assembly adapted for delivering at least two different components, each having a particular  
viscosity, optionally together with an additional diluent, to form a beverage. The adapted  
beverage assembly includes an outer chamber having at least two separate compartments  
for receiving and storing therein at least two different components, each compartment  
having a predetermined volume occupied by the component(s) therein; and a fitment  
35 attached to each of the compartments and having a predetermined orifice size, wherein the  
occupied volumes and orifice sizes of the compartments are varied, depending on the  
particular viscosities of the components therein, to provide the appropriate flow rates, and a

desired ratio, of the components upon delivery and formation of the beverage, such that the  
5 compartments become empty at substantially the same time.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

The details of the preferred embodiments of the invention are illustrated in the appended drawing figures, wherein:

10 FIG. 1 shows an exploded schematic of the elements of a preferred dispensation system and how they fit together; and

FIG. 2 shows a diagrammatic view of a preferred dual packaging assembly and coupling elements for connecting to the dispensation system.

15 FIG. 3 shows another embodiment of the invention in which the dual packaging assembly has an outer container distinct from the inner compartments containing the components.

### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

A suitable dispensation system according to the principles of the invention  
20 may be produced by modifying an existing commercially available system in a way suitable to accommodate the necessary components described herein. Examples of suitable commercial systems or commercial systems readily modifiable-include, for example, those manufactured by Karma, Inc., of Watertown, WI, particularly Dispenser Model 670 or 672. Modification of one or more elements of commercial dispensation systems can vary  
25 depending upon many factors, for example, such as the (high) viscosity of one or more of the at least two components and/or a distinct difference in the viscosities of two of the components. Preferably, a volumetric positive displacement pump, such as a peristaltic pump, should be used and may be substituted for a different type of pump, if found in commercial dispensation systems. When two or more liquid components are used, the  
30 dispensation system may include a single-head pump for each liquid component or a smaller number of dual- or multi-head pumps. Exemplary commercial volumetric pumps for use with the invention include, but are not limited to, MityFlex peristaltic pumps, available from Anko Products, Inc., of Bradenton, FL, and peristaltic or dispensing pumps commercially available from Watson-Marlow of Cheltenham, England.

35 Preferably, each of the at least two components may be packaged in its own pouch or bag, with each pouch or bag being stored in a separate compartment within a single outer chamber, for instance, in the form of a cardboard or other suitable box with a

single compartment or chamber, with the at least two components being stored in a one-  
5 piece, dual compartment package, such that each compartment being connected to at least  
one other compartment by a suitable connection means. Alternately, the outer chamber may  
contain at least two chambers. Preferably, two or more pouches may be heatsealed  
together, or a single pouch separated into two or more chambers or cavities by a heatseal  
preferably extending from one end of the pouch to the other, to isolate the at least two  
10 components from each other while keeping their receptacles together.

In a preferred embodiment, the packaging assembly contains two or more,  
preferably two, webs of film that can be heatsealed to form two or more enclosures or  
pouches connected together in a row or in series. Preferably, the packaging assembly is  
capable of being folded at each heatseal. More preferably, the folds are alternating, such  
15 that each heatsealed end is folded back on itself, resulting in a zig-zag, or accordion,  
arrangement of the enclosures or pouches. Advantageously, the packaging assembly serves  
to keep separate the at least two components until they are dispensed.

In this way, through separation of the at least two components, it is believed  
that several advantages may be gained, for example, by avoiding certain shortcomings of  
20 products having components mixed prior to dosing, which disadvantages may include the  
following: one component may cause or accelerate the degradation or deterioration of  
another component, for example, during shipping or storage or within the dispensing  
apparatus or equipment, if the two components are mixed prior to dispensation; one  
component may "phase separate" from another component, for example, by settling,  
25 agglomerating, aggregating, solidifying, liquefying, forming a precipitate, forming another  
liquid phase, or in some other way causing an unevenly or non-uniformly mixed product to  
result, between the time the components are mixed together and the time the component  
mixture is dosed or dispensed; or both.

In another embodiment, each component enclosure or pouch, preferably of a  
30 packaging assembly, contains a dispensing fitment to allow each component to be  
dispensed. Each fitment may advantageously be connected to a gland in the dispensing  
system with any suitable connection system, *i.e.*, gland and fitment, for example,  
commercial connectors, such as a Clean-Clic® fitment (*i.e.*, as disclosed in Netherlands  
Patent No. NL 9400346 A or in International Publication No. WO 95/24972, the entire  
35 disclosure of which publications are hereby incorporated herein by reference hereto),  
commercially available from Innovative Packaging Netherlands, of Heemstede, The  
Netherlands, or a Scholle fitment, commercially available from Scholle Co., of Irvine,

California. Preferably, the connection would possess, and the fitment would allow, a quick  
5 disconnect type function. In an alternative embodiment, the glands could be part of the  
packaging assembly and the fitments could be connected to the pump assembly with  
appropriate tubing.

The addition chamber may be any chamber, into which the at least two  
components may be pumped (and optionally into which a diluent may be pumped).  
10 Preferably, the chamber is suitable to allow the at least two components (and optionally the  
diluent) to come into contact or to allow their mixing before being dispensed as a  
consumable beverage. This addition of components in the chamber may result in intimate  
mixing, but intimate mixing may not be necessarily required. The addition chamber  
advantageously serves as a contacting chamber for some or all of the components. In one  
15 embodiment, all the components (including the optional diluent) come into contact, or are  
mixed, in the addition chamber. In another embodiment, the at least two components come  
into contact, or are mixed, in the addition chamber, but the diluent is added later. In yet  
another embodiment, at least two of the components and/or diluent(s) initially come into  
contact, or are initially mixed, forming a component combination separate from the  
20 remaining components. In this embodiment, the initial contact or mixing may occur before,  
after, or in the addition chamber, with the remaining components being later brought into  
contact, or later being mixed, with the initial component combination.

The beverage product to be dispensed may include, but is not limited to, a  
coffee-type beverage, *e.g.*, including coffee-based, coffee-flavored, or mocha-flavored  
25 beverages, or a mixture thereof; a carbonated beverage, *e.g.*, such as soda, cola, flavored  
seltzer, or the like, or a mixture thereof; a juice beverage; another type of flavored beverage;  
a creamy beverage, *e.g.*, including milk-based or non-dairy creamer-based fats or  
components; or a combination thereof. Preferably, the beverage product to be dispensed is  
a creamy and/or a coffee-type beverage.

30 The at least two components may be separately stored in separate containers,  
which are secured together, or may alternately be stored separately in separate  
compartments of a single container. The containers are preferably dispenser containers. In  
one embodiment, the at least two separate components may be a coffee base concentrate  
and a coffee aroma. In another embodiment, the at least two separate components may be a  
35 heavy liquor and a distillate.

The flow rate at which each compartment is emptied should be uniform and  
may depend upon various inherent and design characteristics, for example, such as product



viscosity, compartment capacity, fitment size, and the like. Uniform emptying is important  
5 to prevent waste or improper beverage preparation. For example, if the aroma component  
compartment is emptied before the coffee concentrate component, then the resulting coffee  
will probably have an undesirable taste in the absence of aroma.

The viscosities of the different components may vary greatly, depending on,  
among other things, the nature of the resulting beverage and the storage or usage  
10 temperature, but all preferably fall within the range of about 0.1 cPs to 10,000 cPs. In one  
embodiment where two components with different viscosities are present, the ratio of the  
larger to the smaller viscosity is from about 200 to 5,000, preferably from about 500 to  
2,000, more preferably about 1,000. In a preferred embodiment, two components are  
present and preferably have viscosities from about 0.1 cPs to 10 cPs and from about 200 cPs  
15 to 10,000 cPs, respectively, more preferably from about 0.5 cPs to 2 cPs and from about  
500 cPs to 7,500 cPs, respectively, most preferably of about 1 cPs and from about 1,000 cPs  
to 5,000 cPs, respectively.

The compartment capacities of each compartment of the packaging assembly  
and the occupied volume of the component(s) therein may vary greatly, depending on a  
20 number of factors, *e.g.*, such as the viscosity of the component(s) to be placed therein, the  
fitment size, the appropriate amount of the component(s) therein in each dispensed beverage  
product, and the relative ratio of the components in each of the compartments. In one  
embodiment, the compartment capacities and occupied volumes may be between about 50  
mL and 10 L, preferably between about 100 mL and 5L, more preferably between about  
25 200 mL and 4L. The occupied volume of each compartment is typically less than the  
compartment capacity, although they may also be substantially the same.

The size of the orifice of the fitment of each compartment according to the  
invention depends on factors such as the viscosity, desired flow rate, and amount of the  
component(s) therein, as well as the relative ratio of the components in each of the  
30 compartments.

The relative ratio of the components in each of the compartments may also  
vary greatly, depending on the nature of the beverage product. When only two  
compartments are present in the packaging assembly, it is preferable that the relative ratio  
of the component(s) in the two compartments is from about 20:1 to 1:20, preferably from  
35 about 10:1 to 1:10, more preferably from about 5:1 to 1:5.

The volumetric flow rates of the components in each compartment may vary  
greatly, depending on any of the previously stated conditions or properties, such as those

indicated above. In a preferred embodiment, each volumetric flow rate is from about 1  
5 mL/min to 100 mL/min, preferably from about 5 mL/min to 50 mL/min, more preferably  
about 20 mL/min to 35 mL/min.

Optionally, the dispensation system may include a piping system that  
connects some or all of the different elements of the dispensation system. This piping  
system includes any suitable type of piping or tubing, typically those made of flexible  
10 polymeric materials, for contacting and dispensing consumable beverages. Examples of  
suitable piping include food grade plastics, such as PTFE, PE, HDPE, PP, PVC, silicones,  
and the like. For example, TYGON® and NORPRENE® are two types of tubing that could  
be used.

Optionally, especially when the at least two components are viscous or semi-  
15 viscous liquids or concentrates, the dispensation system according to the invention may also  
include a means for providing a diluent for the liquids or concentrates. This diluent may be  
any consumable liquid, including, but not limited to, water (hot, cold, or tepid, preferably  
hot), carbonated water (including seltzer or club soda), a milk or non-dairy milk-type  
product, a solution containing any of these, or any mixture thereof. It should be understood  
20 that when the diluent is susceptible to bacterial contamination, for example, when a milk  
product is used as a diluent, the dispensation system should include provision for inhibiting  
or preventing such contamination, *e.g.*, such as sterile piping.

The means for providing a diluent in the dispensation system according to  
the invention may be any suitable means, but should include a diluent container and a  
25 mechanism for providing the diluent to the at least two components upon or prior to  
dispensation. The diluent may be provided by any suitable method known in the art, *e.g.*,  
such as the aforementioned piping detailed herein, and may be controlled, for example,  
using a manual or mechanically activatable valve or using a pump mechanism. In some  
cases, the pumping mechanism may already be included in the pumping system of the  
30 dispensation according to the invention, especially if the pump assembly includes a multi-  
head pump. Alternately, the mechanism for pumping may include any pump assembly  
and/or any piping system stated above for use in the dispensation system according to the  
invention. If the diluent to be provided must be kept at a particular temperature, a heating  
or cooling unit or both, as well as a means for monitoring and/or controlling the temperature  
35 within the diluent container may be present in the dispensation system according to the  
invention.

In a preferred embodiment, the present invention provides a beverage system  
5 for providing a coffee beverage, the beverage system comprising a container including a first storage compartment containing a coffee base concentrate having a soluble coffee solids concentration of at least 10% by weight and from which coffee aroma has been removed, and a second storage compartment containing coffee aroma.

For food service applications, the coffee base concentrate and the coffee  
10 aroma may be separately stored in suitable dispenser containers. The containers may be separate for the coffee base concentrate and the coffee aroma or a single container having separate storage chambers may be used. The containers can advantageously be pouches made from, for example, barrier films which are able to keep water vapor, oxygen, and light transmission to a minimum. Suitable barrier films are commercially available, for example,  
15 containing laminated layers of polyester/aluminum/polyethylene, or the like.

For retail applications of coffee-based beverages, the two components are preferably packaged in suitable containers which have separate storage chambers for the coffee base concentrate and the coffee aroma. Suitable containers include multi-compartment stick packs; sachets; carton-based, tetrahedron packs; UNIFILL packs;  
20 squeezable plastic bottles; stand up pouches; plastic cups; etc. The containers are preferably designed such that opening of the container opens both chambers such that both the coffee base concentrate and the coffee aroma are simultaneously available for reconstitution of the beverage.

One aspect of this invention is based upon the finding that the separate  
25 storage of concentrated soluble coffee solids and coffee aroma significantly improves the stability of the concentrated soluble coffee solids. Therefore, by separately storing the coffee base concentrate and coffee aroma and recombining them upon reconstitution, a coffee beverage of good quality may be provided.

The coffee base concentrate may be obtained using any suitable procedure  
30 since the exact procedure used is not critical. Usually, the coffee base concentrate is prepared by concentrating a coffee extract obtained from a coffee extraction process to the desired coffee concentration. The coffee extract may be produced in the usual manner by subjecting roasted coffee beans to extraction. Any suitable extraction procedure may be used because the choice and design of the extraction procedure is a matter of preference and  
35 has no critical impact on the invention. Suitable extraction procedures are described in U.S. Patent Nos. 5,997,929 and 5,897,903, the disclosures of which are incorporated by reference. Similarly, any suitable concentration procedure may be used because the choice

and design of the concentration procedure is a matter of preference and has no critical  
5 impact on the invention. Of course, the coffee base concentrate may also be prepared by  
dissolving soluble coffee powder in water to the desired concentration.

The concentration of the coffee base concentrate is at least about 10% by  
weight in soluble coffee solids, for example at least 30% by weight. Preferably the  
concentration is high enough such that the concentrate will not support the growth of  
10 microorganism, for example about 50% to about 65% by weight. The concentration may be  
more than 65% by weight but then dispensing becomes more difficult due to increasing  
viscosity.

The coffee base concentrate may be treated to account for or reduce the  
formation of acids during storage. To account for the formation of acids during storage, the  
15 pH of the coffee base concentrate may be raised about 0.5 to 1.0 unit higher than original  
pH. The pH will still fall during storage but the coffee base concentrate will not become  
too acidic during acceptable shelf life times. The pH may be raised using any suitable  
procedure. For example, an alkali may be added to the coffee base concentrate to raise the  
pH. Suitable alkalis include sodium hydroxide, calcium hydroxide, potassium hydroxide  
20 and sodium bicarbonate.

Alternatively, the pH may be raised using ion exchange process with an ion  
exchange resins. This offers the advantage that the no additives are added to the coffee base  
concentrate. Alternatively, a combination of adding alkali and ion exchange can of course  
be performed. It is preferred that the coffee base concentrate is obtained from extract  
25 subjected to ion exchange treatment to raise pH.

It may be advantageous to store coffee base concentrate in a refrigerated or  
frozen condition, preferably frozen. This has the advantage that the stability of coffee base  
concentrate may be improved.

The formation of acids may be reduced or prevented by inducing hydrolysis  
30 of the acid precursors in the coffee base concentrate. This may be done by raising the pH to  
cause the acid precursors to form stable salts and then reducing the pH of the concentrate.  
This may be done by adding alkali as described in European patent application 0861596 or  
by using ion exchange. Usually the pH will be raised to above about 9. The pH may again  
be lowered to a normal coffee pH range using suitable acids or ion exchange. Alternatively,  
35 the acid precursors may be thermally hydrolyzed or enzymatically hydrolyzed, for example  
by using an esterase.

5 The formation of acids may also be reduced or prevented by removing acid precursors from the coffee base concentrate using membrane fractionation process. It is preferred that the coffee base concentrate is obtained from extract subjected to membrane fractionation. Suitable membranes are commercially available.

It is also possible to add an alkali to the base coffee concentrate at the time of reconstitution of the beverage. This may be done by dispensing an alkali along with the  
10 base coffee concentrate.

The coffee base concentrate should be substantially free of coffee aroma. Processing the roasted coffee beans to a coffee base concentrate, as described above, will result in the loss of substantially all coffee aroma from the coffee base concentrate. However, it is preferred to specifically strip off and then collect the coffee aroma during  
15 processing. In this way, the coffee aroma is separated from the concentrate but is not lost. Processes for stripping off and collecting the coffee aroma are well known. Usually coffee aroma is stripped off at one or more stages; for example using an inert gas during, or immediately after, grinding of the coffee beans, and using steam to strip coffee aroma from the coffee extract during extraction.

20 Alternatively, the fresh coffee grounds may be slurried in water or coffee extract and the coffee aroma stripped from the slurry. A suitable procedure is described in U.S. Patent No. 6,149,957, the entire disclosure of which is expressly incorporated herein by reference thereto.

The coffee aroma may be captured using any suitable procedure. Ordinarily,  
25 the coffee aroma is captured by condensing from the carrier gas it in one or more condensers. Preferably more than one condenser is used; each succeeding condenser being operated at a lower temperature than the previous condenser. If necessary or desired, one of the condensers may be a cryogenic aroma condenser. A suitable cryogenic aroma condenser is described in U.S. Patent No. 5,182,926, the entire disclosure of which is  
30 expressly incorporated herein by reference thereto. The captured coffee aroma may, if desired, be concentrated using a suitable technique such as partial condensation or rectification.

The captured coffee aroma may be combined with a suitable carrier substrate such as coffee oil or an emulsion containing coffee oil.

35 The processes for the production of the coffee extract and capture of the coffee aroma may be carried out under oxygen reduced or oxygen free conditions if desired. This may be accomplished as is known in the art; for example by carrying out the processes

under a blanket of inert gas. Further, deoxygenated water may be used whenever water is  
5 necessary in the process.

The coffee aroma is preferably stored under oxygen reduced or oxygen free conditions. Similarly, the coffee base concentrate may stored under oxygen reduced or oxygen free conditions. Further, if desired, oxygen scavengers may be added to the coffee aroma and/or coffee base concentrate. Suitable oxygen scavengers are described in U.S.  
10 Patent No. 6,093,436, the entire disclosure of which is expressly incorporated herein by reference thereto. If further desired, coffee aroma can be stored under refrigerated or frozen condition. This has the advantage that the stability of the aroma may be improved.

The dispensation system according to the invention may also optionally include other components that may provide some functional or aesthetic benefit. Among  
15 the optional components include a control system, a switch board, a dispenser housing, a drip pan, a hot or cold water tap, and a frame on which one or more of the elements of the dispenser system according to the invention may rest or be attached or supported.

Another aspect of the present invention involves a method for dispensing a beverage containing at least two components, preferably viscous or semi-viscous liquids or  
20 concentrates, which method includes: storing the at least two components separately in a single packaging assembly; combining the at least two components together, optionally, along with a diluent to form a consumable beverage; and dispensing the consumable beverage for consumption by a consumer, wherein at least one of the at least two components being stored in a compartment separate from at least one other of the at least  
25 two components.

In one preferred embodiment, shown in FIG. 1, the dispensation system contains a dual container 2; a pump assembly 17, containing a peristaltic pump housing 6 and a pump motor 16; an addition chamber 12 having three inlets, two for the piping, 4a and 4b, from each of the two components, and one for the piping 18 leading to the diluent tank  
30 11; a connector assembly 19, having dual glands, 1a and 1b, for connecting to the fitments on the outer container 2; and a dispenser frame-20,<sup>12</sup> including a housing 8 and a door 9.

Preferably, the dual container shown in FIG. 2 includes two component pouches, 21a and 21b, which are connected by two webs of film heatsealed together along a sealing line 21c substantially along the median of the webs. Alternately, instead of by  
35 heatsealing, the pouches could be adhesively secured together, for example, by any suitable adhesive or thermofusible intermediate film or hot melt material. Each component pouch includes a female pouch fitment, 22a and 22b, which advantageously protrudes outside the

pouch surface and forms an orifice, 23a and 23b, of a size depending upon, among other  
5 things, the viscosity and required dispensing ratios of the components. Each fitment is  
configured to be securable to one gland, 1a or 1b, preferably by "push-and-lock" assembly,  
to enable flow from both pouches through portions of respective connecting tubes or pipes,  
4a and 4b, connected to the glands, 1a and 1b. Externally, the dual container may be treated  
as one single packaging assembly. The packaging assembly can be placed in the  
10 dispensation system very conveniently to allow dispensation of the components to form a  
beverage product. In an alternative embodiment (not shown), the two pouches could fold  
over, preferably substantially at the median or at the heatseal, so that the two fitments are  
situated coaxially, thus allowing connection to a single dispensing gland to enable flow  
therefrom.

15 Alternatively, as shown in FIG. 3, the component pouches, 21a and 21b, are  
stored as two separate members placed contiguously a single container that maintains them  
together. Each component pouch has a female pouch fitment, 22a and 22b. These pouch  
fitments, 22a and 22b, can connect to the dual glands, 1a and 1b, preferably with a quick-  
disconnect type release mechanism.

20 The fluid flow couplings may preferably include those of the "dry break"  
type, for example, such as those disclosed in U.S. Patent Nos. 5,609,195, 5,467,806, and  
5,816,298. More particularly, the fluid flow couplings refer to a connection between a first,  
male part and a second, female part, through which connection fluid may flow. When the  
couplings parts are disconnected, they mutually reseal to prevent loss of fluid from either  
25 tubing(s) or container(s). Additionally, the "dry break" aspect of these couplings implies a  
desirably minimal fluid retention volume, so that fluid is not sealed in either the first or  
second coupling parts, thus minimizing exposure to, or release into, ambient conditions.

The term "about," as used herein with respect to a range of values, should be  
understood to modify either value stated in the range, or both.

30

### **EXAMPLES**

The following examples are only representative of the methods and materials  
for use in dispensation systems according to the invention or any element(s) thereof, and are  
not to be construed as limiting the scope of the invention in any way.

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### Example 1

5               Roast and ground coffee was fed into a slurry tank along with a coffee extract containing about 8 to 10% by weight of soluble coffee solids. The resulting slurry was fed to the top of a disc and donut stripping column using a slurry pump. Steam at a low pressure of less than about 20 kpa (gauge) was fed into the bottom of the stripping column. The stripping rate was 50% by weight of steam compared to roast and ground coffee.

10              The aromatized gas stream leaving the stripping column was subjected to concentration by rectification in a packed rectification column. The liquid condensing in the rectification condenser was collected and comprises about 10% by weight of the roast and ground coffee. The coffee aroma was placed in glass vials and protected from oxygen.

                The stripped slurry leaving the stripping column was then subjected to  
15 extraction in a continuous extraction system made up of three extraction reactors and two solubilization reactors. The system is as described in U.S. Patent No. 5,897,903, which has been incorporated by reference. The extraction reactors are operated at 120°C, 110°C, and 110°C, respectively. The solubilization reactors are operated at 1.75 MPa for 5 minutes and 1.75 MPa for 8 minutes respectively. The water used in the extraction system was  
20 deoxygenated and an inert blank was used with the system to reduce oxygen ingress.

                The extract obtained is called stripped extract. This stripped extract was further concentrated using a evaporation system to provide a coffee base concentrate containing about 55% by weight of soluble coffee solids. About 0.75% to 1% of sodium hydroxide (by weight relative to coffee solids) was added to the coffee base concentrate.  
25 This amount of Sodium hydroxide was sufficient to neutralize acid formation over a period of 6 months. The coffee base concentrate was then filled in glass vials and held under inert gas conditions.

                Three sample groups were prepared for storage. For the control group, coffee base concentrate was combined with coffee aroma at a level of about 10% coffee  
30 aroma and frozen at -40°C. The coffee base concentrate and coffee aroma were protected from oxygen during the process.

                The prior art formulation was made by combining coffee base concentrate with coffee aroma at a level of about 10% coffee aroma and filled into glass vials. The coffee base concentrate and coffee aroma were protected from oxygen during the process.

35              For Example 1, the coffee base concentrate and coffee aroma were separately stored in the glass vials. The vials of the prior art formulation and Example 1 were stored at 20°C under an inert gas for up to 6 months.



A coffee beverage was prepared from each sample group over the period of the storage trial and evaluated by a panel using the "Difference from Control" sensory evaluation method. When preparing beverages of Example 1, about 10% by weight coffee aroma was added to the base coffee concentrate. Each of the storage samples was evaluated against to the frozen control. Each panelist gives a score between 1 and 10 to indicated the degree of difference. If the score is 9 and 10, this means that the panelist could not tell the storage sample as being different from frozen control. If the score is between 6 to 8, a difference from frozen control is detected but the difference is acceptable. If the score is below 6, the difference between the storage sample and the frozen control is not acceptable. If a score below 9 is given, each panelist is asked to describe the differences under the following attributes: cloudiness, coffeeness, roastyness, pruneiness/molasses, acidity, bitterness and body. Panelists are also free to use other attributes to describe the differences. At the end of evaluation, the panel give a consensus score for the samples being evaluated.

The beverages prepared from the samples of Example 1 scored values of 6 to 8 during the trial. After six month storage, the differences are (1) less coffeeness, (2) less roastyness and (3) some development of green, woody characteristics. However, the differences are acceptable. The beverages prepared from the prior art formulation scored values of less than 6 and were not acceptable.

#### Example 2

The process of Example 1 was repeated except that, instead of adding sodium hydroxide to the coffee base concentrate, the stripped extract was subjected to membrane fractionation process, specifically ultra-filtration, using a membrane with a 3.5K molecular cut off such that about 25% of coffee solids was removed in the permeate. It is preferred to membrane fractionate the stripped extract to prevent loss of aroma during processing. And then the retentate was further evaporated to form coffee base concentrate. The coffee base concentrate and coffee aroma were separately stored in the glass vials. The beverages prepared from the coffee base concentrate and coffee aroma of Example 2 scored values of 6 to 8 during the trial.

#### Example 3

The process of Example 1 was repeated except that, instead of adding Sodium hydroxide to the coffee base concentrate, the stripped extract was passed through

an ion exchange column containing DOWEX 22 resins to raise the pH to a value equivalent  
5 to the addition of 1% sodium hydroxide (by weight relative to coffee solid). It is preferred  
to use stripped extract to minimize the damage of coffee aroma during processing. The  
treated stripped extract was further evaporated to form coffee base concentrate. The coffee  
base concentrate and coffee aroma were separately stored in the glass vials. The beverages  
prepared from the coffee base concentrate and coffee aroma scored values of 6 to 8 during  
10 the trial.

#### Example 4

The process of Example 1 was repeated except that the coffee aroma was  
stored under frozen condition. The beverages prepared from the coffee base concentrate  
15 and the frozen stored coffee aroma scored values of 6 to 8 during the trial.

#### Example 5

The coffee base concentrate and the coffee aroma of Example 1 were each  
inoculated with a microbial cocktail containing 32 yeast, 22 mold and 15 lactic acid bacteria  
20 strains. The samples were stored at 20°C. No growth was detected and all organisms had  
ceased to be viable after two weeks or longer.

#### Example 6

A packaging assembly according to the invention contains two  
25 compartments, A and B, each with a compartment capacity of slightly greater than 1 liter  
and each possessing an attached fitment with an orifice having a diameter of about 4 mm.  
In compartment A is a coffee concentrate having a viscosity between about 1,000 cPs and  
5,000 cPs. In compartment B is a coffee aroma distillate having a viscosity of about 1 cPs.  
In this case, the relative ratio of the coffee concentrate to the coffee aroma in the beverage  
30 product is about 1:1.

#### Example 7

A dispensation system according to the invention contains the packaging  
assembly of Example 6, as well as connecting glands, a dual head pump assembly, mixing  
35 chamber, diluent tank, and connective tubing.

#### Example 8

5 A beverage product provided by the dispensation system of Example 7 can  
advantageously be dispensed according to a method of the invention. As such, the two  
components are pumped at a predetermined flow rate of about 30 mL/min into a mixing  
chamber of the dispensation system, in which they are mixed together and diluted with  
about 170 mL of hot water (temperature of about 70°C to 90°C). The resulting mixture is  
then dispensed for consumption.

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While the foregoing description represents the preferred embodiments of the  
present invention, it will be understood that various additions and/or substitutions may be  
made therein without departing from the spirit and scope of the present invention. One  
skilled in the art will appreciate that the invention may be used with many modifications of  
15 structure, forms, arrangement, proportions, materials, and components used in the practice  
of the invention and which are particularly adapted to specific environments and operative  
requirements, without departing from the principles of the present invention. The presently  
disclosed embodiments are therefore to be considered in all respects as illustrative and not  
restrictive.

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